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In the heterotypic mitosis STRASBURGER interprets the double condition as a parallel conjugation and not as an early splitting, and in this parallel conjugation he finds the explanation of the reduction from the $2x$ to the x number of chromosomes. *Galtonia candicans* furnishes particularly strong evidence that there is a pairing rather than a splitting.

STRASBURGER was one of the first to claim that the nucleus is the physical basis of heredity. Since it has been urged that other structures are concerned, the sperm nuclei of Lilium were carefully reexamined, and it was found that only the nucleus, with no trace of cytoplasm from the pollen tube, enters the egg.

The book closes with some interesting suggestions in regard to the origin and development of the nucleus: The original protoplasm had no nuclei, all its parts being capable of both formative and nutritive functions. Then there was a gradual separation of formative and nutritive parts, and the formative parts were the first differentiated carriers of hereditary qualities. At first they were scattered in the cytoplasm, but later became grouped, as in the Cyanophyceae. Next the nucleus would be marked off from the cytoplasm by a membrane. Simple constriction might suffice for the division of such a nucleus, but as the difference between hereditary units became so great that each unit carried only one quality, a more exact division would become necessary. The units would become arranged longitudinally in a thread, where they would undergo a doubling, and the longitudinal division of the thread would separate the product of that doubling. The complete resemblance between the mitoses of higher plants and animals makes this sequence very probable.

The book touches upon almost every phase of cytological investigation and consequently only a few of its more important features can be mentioned in a review.—CHARLES J. CHAMBERLAIN.

Biology of chlorophyll

Starting from the complementary colors of marine algae, an accepted adaptation to the light at varying depths, as suggested by ENGLEMANN (1883), and the complementary tints attained promptly by certain Oscillatoriae, when exposed to light of differing hues, as shown by GAIDUKOW (1902), STAHL proposes to inquire[5] why plants are green and not some other color, and whether the green of land and water plants is not an adaptation to the composition of sunlight, modified by its passage through the atmosphere. Citing the results of physical investigations to show that in diffuse light the blue and violet rays prevail, and in direct sunlight the red and yellow, he claims that an unrecognized relation exists between these facts and the selective absorption of the chlorophyll. The yellow component serves to absorb the blue-violet; the green component the red-yellow. The yellow pigment is complementary to the blue of the sky, and the green to the red-yellow rays which pass through an atmosphere whose haziness becomes evident to our eyes when the sun is low. As the red Florideae are colored in complement to the green-blue rays least weakened by traversing sea water, so the green and yellow of chlorophyll are complementary to the red and blue that traverse the atmospheric sea. It thus appears that the yellowish green of vegetation is really an adaptation to the composition of diffuse light.

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[5] STAHL, ERNST, Zur Biologie des Chlorophylls: Laubfarbe und Himmelslicht: Vergilbung und Etiolement. 8vo. pp. vi+154. *pl. 1.* Jena: Gustav Fischer. 1909. *M* 4.

Various lines of reflection, more or less closely related to this idea, are elaborated, such as, Regulation of the absorption of the sun's rays; Variable content of chlorophyll in nutritive organs; Biology of non-green algae; Etiolation, autumnal yellowing, and their biological significance.

The book is almost purely philosophical, only a few experiments, and these avowedly superficial, being recorded. Of course the general thesis does not touch the fundamental reason for plant coloration, and it is doubtful whether there is any logical gain in this mode of looking at the facts. To give it validity, it must be shown that the absorption of other rays by different pigments (and consequently a different colored vegetation) would be nutritively inefficient. Considering the fact that most plants get far more energy than they can use at ordinary temperatures, by reason of the inadequate supply of CO_2, it would surely be difficult to show this.—C. R. B.

MINOR NOTICES

Bacterial classification.—JENSEN has attacked the difficult problem of bacterial classification with a view to making a "natural system," that is, one which will express relationship by descent.[6] Most attempts to classify bacteria have been based first upon form or upon mode of cell division, and then upon physiologic characters. This method has led to many anomalies. For example, in one sharply defined family, the red sulfur bacteria, there are found rod, spiral, and round forms; and in the case of certain species of Crenothrix and Azotobacter, division occurs first in one, later in three planes. JENSEN argues that bacteria with a single flagellum, or with tufts of polar flagella, are closely allied, but that these are sharply differentiated in fermentative as well as other reactions from those having flagella distributed over the cell-body. Hence he divides the whole bacterial kingdom into two orders: (1) Cephalotrichinae and (2) Peritrichinae. In the former he groups seven families, in the latter four families. For genera he selects, as a means of discrimination, the oxidizing, reducing, fermentative, and other chemical processes of metabolism, as shown by the work of himself, WINOGRADSKY, BEIJERINCK, KASERER, BURRI and STÜTZER, MOLISCH, OMELIANSKI, BÜCHNER, and others. JENSEN regards the genus Methanomonas as the origin of all organic life, since this autotrophic, monotrichial, rodlike form builds up its cell substance in the simplest manner possible, without requiring either organic carbon, organic nitrogen, or outside energy such as light or heat. On the contrary, a certain

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[6] JENSEN, O., Die Hauptlinien des natürlichen Bakteriensystems nebst einer Uebersicht der Gärungsphänomena. 8vo. pp. 42. *fig. 1.* Jena: Gustav Fischer. 1909. *M* 1.